

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C.**

In the Matter of)	
)	
Service Rules for the 746-764 and 776-794 MHz)	WT Docket No. 99-168
Bands, and Revisions to Part 27 of the)	
Commission's Rules)	

REPLY COMMENTS OF MOTOROLA

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Summary

Over 30 parties commented on the FCC's proposed service rules affecting the 36 MHz commercial allocation in the 746-806 MHz band. While commenters largely support the goals of the FCC and Congress to maximize the effective use of the 746-806 MHz band, there is clearly a difference of opinion on how that is best accomplished.

Motorola opposes the broad flexible use proposals modeled on the Part 27, Wireless Communications Service Rules and instead urges the FCC to embrace its role as US spectrum manager to maximize the public interest benefits derived from this allocation. The FCC must accept the difficult task, mandated by law, of assessing the needs of competing commercial uses of this spectrum, weighing the public interest pros and cons, and then allocating and channelizing the band accordingly. The Commission is also compelled to manage the commercial use of this spectrum in large part to protect public safety operations in adjacent spectrum. Indeed, the Commission's highest priority should be to ensure that the services licensed in the commercial spectrum are compatible with the public safety operations authorized in adjacent spectrum.

The record clearly supports the use of this spectrum for mobile wireless services to meet the increasing spectrum demands of commercial operators and to resolve the frequency congestion currently experienced in the private land mobile services. Using the 746 MHz band for these applications will promote more compatible spectrum use with adjacent services, including public safety allocations, than would permitting additional in-band, high-power TV broadcast operations.

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Motorola Inc. (Motorola) hereby replies to the comments filed in response to the *Notice of Proposed Rule Making* in the above-captioned proceeding.¹

I. Introduction

Over 30 parties commented on the FCC's proposed service rules affecting the 36 MHz commercial allocation in the 746-806 MHz band. While commenters largely support the goals of the FCC and Congress to maximize the effective use of the 746-806 MHz band, there is clearly a difference of opinion on how that is best accomplished.

In its opening round Comments, Motorola opposed the broad flexible use proposals modeled on the Part 27, Wireless Communications Service Rules and instead urged the FCC to embrace its role as US spectrum manager to maximize the public interest benefits derived from this allocation. In Motorola's view, the FCC must accept the difficult task, mandated by law, of assessing the needs of competing commercial uses of this spectrum, weighing the public interest pros and cons, and then allocating and channelizing the band accordingly. As further explained in these Reply Comments, the

¹ *Service Rules for the 746-764 and 776-794 MHz Bands, and Revisions to Part 27 of the Commission's Rules*, WT Docket No. 99-168, *Notice of Proposed Rule Making*, FCC 99-97, released June 3, 1999 [*hereinafter Notice*].

Commission is also compelled to manage the commercial use of this spectrum in large part to protect public safety operations in adjacent spectrum. Such actions are at the very core of the FCC's existence and fully consistent with its original charter to promote the safety of life and property through the use of wire and radio communication. Indeed, the Commission's highest priority should be to ensure that the services licensed in the commercial spectrum are compatible with the public safety operations authorized in adjacent spectrum.

II. The Record Does Not Support the Flexible Allocation Proposal.

In its opening round comments, Motorola stated that the FCC should adopt rules that allocate this spectrum to particular services rather than solely relying on the auction process to maximize the use of this spectrum.² Without sufficient service definition, Motorola cautioned that manufacturers would not have incentive to invest in broad product development.³

Numerous other commenters echoed these concerns. Arraycom, for example, warned against emulating the flexible allocation approach used for the 2.3 GHz Wireless Communications Service because those rules do not ensure that the spectrum is providing meaningful benefits to the public.⁴ Arguing that spectrum utilization decisions should not be left to the market alone to decide, TIA argues that “unbridled spectrum flexibility” leads to fractured markets, increased equipment costs, delayed research, product

² Comments of Motorola, WT Docket No. 99-168, at 3.

³ *Id.* at 4.

⁴ Comments of Arraycomm, Inc., WT Docket No. 99-168, at 3,4.

development and time to market, and increased potential for interference among users.⁵

ITA agrees and states that too much flexibility promotes uncertainty in the market.⁶ ITA joins numerous other private wireless interests, including UTC, MRFAC, and APCO, to request the FCC actively manage the use of this spectrum by allocating a portion of the band to the private land mobile service.⁷

As further discussed below, the record clearly supports the use of this spectrum for mobile wireless services to meet the increasing spectrum demands of commercial operators and to resolve the frequency congestion currently experienced in the private land mobile services. Using the 746 MHz band for these applications will promote more compatible spectrum use with adjacent services, including public safety allocations, than would permitting additional in-band, high-power TV broadcast operations.

A. This Spectrum Is Ideally Suited For Mobile Services Applying Frequency Reuse Technologies

Numerous commenters note the particular usefulness of this band for mobile applications. Intek, for example, notes that the allocation of this spectrum affords mobile service providers an essential opportunity to gain access to greatly needed bandwidth and that, given the congestion in existing frequency bands, spectrum below 1000 MHz should be reserved for mobile services.⁸ Likewise, AMTA points out that the band's propagation characteristics are "well-suited" for mobile wireless communications and

⁵ Comments of the Telecommunications Industries Association, WT Docket No. 99-168, at 2.

⁶ Comments of the Industrial Telecommunications Association, Inc., (ITA), WT Docket No. 99-168, at 6.

⁷ See Comments of United Telecom Council (UTC) at 2, Comments of MRFAC, Inc., at 1, Comments of APCO at 5.

indicates that, in particular, its proximity to existing allocations presents significant advantages for rapid equipment development and deployment.⁹ Airtouch also cited the advantages in equipment design due to existing mobile allocations and thus concluded that this band is “particularly desirable and well-suited for terrestrial mobile use.”¹⁰

These points essentially recognize that not all spectrum is the same. The same services deployed in different frequency bands would experience very different implementation problems and would require very different solutions. This argues against a flexible allocation approach that encourages any and all services.

As recognized by AirTouch and others, terrestrial mobile systems would greatly benefit from being in this band by the close proximity to existing allocations. Indeed, the upper adjacent 800 MHz band is home to tens of millions -- approaching 100 million -- of commercial, private and public safety wireless users.¹¹ From a manufacturer’s viewpoint, expanding this base with the 746-806 MHz band represents a huge market potential offering tremendous economies of scale.

In addition, at these frequencies the path loss is large enough to allow reuse of the same spectrum at different locations within a wide geographic area, but not so large that an unrealistic number of cell sites would be necessary to cover a particular geography.

⁸ Comments of Intek Global Corp., at 2.

⁹ Comments of American Mobile Telecommunications Association, Inc. (AMTA) at ii.

¹⁰ Comments of AirTouch, Inc., at 8.

¹¹ With more than 77 million U.S. subscribers to commercial mobile service, the 800 MHz cellular radio service accounts for about 60 million users alone. Further, the LMCC’s rulemaking petition for additional private wireless spectrum estimates that there are over 10 million private radios in operation in the US today. (See Petition for Rule Making, filed by Land Mobile Communications Council, RM Docket No. 9267, Public Notice, released April 30, 1998 [*hereinafter LMCC Petition*].)

More than this, the 700 MHz spectrum is highly appropriate for mobile applications because the issues which result from high-speed motion in a multipath environment are more easily handled by receivers at these frequencies than at higher frequencies.¹² It is for these reasons that AirTouch concludes that mobile services much above the 2-3 GHz band become impractical.¹³

Considering the alternative to mobile services, the interference management involved with having high-site, high-power broadcast services operating on even an adjacent channel basis to low-site, low-power, cellular-type fixed and mobile systems is unfeasible.¹⁴ As further discussed below in Section III, any attempt to craft service rules that would allow fixed and mobile systems as well as traditional broadcast systems would render the spectrum virtually useless for all parties.

This is not to say that service providers should be restricted from providing a broadcast-like service using a non-traditional broadcast scenario. Distributing the same content to many users employing a system of transmitters laid out in a cellular configuration may be appropriate. It is the system characteristics that need to be regulated and not the service content. The Commission must avoid rules that would

¹² There are many excellent discussions of the effects of a mobile wireless device at motion in a multipath fading environment. See Jakes, *Microwave Mobile Communications*, John Wiley & Sons, 1974. See also Lee, *Mobile Communications Engineering*, McGraw-Hill Book Company, 1982. On page 46, Lee explains that “there are practical limits to how much higher the frequency region can be extended for mobile-telephone applications. A prime consideration is that the severity of multipath fading greatly increases as the channel frequency increases.”

¹³ Comments of AirTouch at 10.

¹⁴ US West states that “the laws of physics preclude interference free operation by any wireless system if a traditional broadcast station is operating on the same or nearby spectrum and in the same area.” See Comments of US West at page 8.

permit systems of vastly different configurations in order to minimize interference to systems operating in adjacent and interleaved spectrum.

B. The Record Supports An Allocation for Emerging “3G” Wireless Data and Internet services

Numerous commenters point out the value of this spectrum for advanced wireless data and internet services commonly referred to as “3G”, which represents the third generation of mobile telephony technology.¹⁵ US West, for example, strongly urges the FCC to “adopt service rules that encourage development of service platforms that will support use of the 700 MHz band for the new broadband services needed to satisfy the current and future demand created by the explosive growth of the Internet.”¹⁶ Similarly, AirTouch notes that “the technical characteristics of this spectrum and the timing of its availability make it uniquely suited for 3G mobile telephony and transitional voice needs.”¹⁷

The growth in commercial mobile services since the mid-1980’s has been tremendous,¹⁸ confirming the value that the public places on these services. The industry has done much work to extend the services offered from voice and simple messaging to high-speed mobile data and Internet access and is busily finalizing global standards for 3G technologies. On the spectrum front, a joint committee of industry and government

¹⁵ See, e.g., Comments of SBC Communications, Inc., at 2; Comments of AirTouch Communications, Inc., at 4; Comments of US West, Inc., at 5; Comments of The Rural Telecommunications Group, at 8. See also Comments of the Walt Disney Company at 4.

¹⁶ Comments of US West at 1,2.

¹⁷ Comments of AirTouch at 4.

¹⁸ Wireless subscribership information from the Cellular Telecommunications Industry Association (<http://www.wow-com.com>) shows 30,000 wireless subscribers in 1985, and 69,000,000 subscribers in 1998. This is an average yearly growth rate of 81%. Since

spectrum leaders has concluded that an additional 160 MHz of spectrum will be needed in the US by the year 2010 to support the anticipated demand for 3G services.¹⁹ Indeed, the FCC cannot appear to keep pace with the growth of commercial mobile services.²⁰ Motorola strongly supports the position of these many commenters who recognize the usefulness of this spectrum to address the need for advanced wireless data services.²¹

It is important to note that 3G systems encompass both mobile and fixed applications. As it is being considered and developed, the deployment of one “3G” service mode in a geographic area does not prohibit the deployment of the other mode in the same area using adjacent spectrum because the fixed and mobile applications are complimentary and compatible operations. This is consistent with the flexible framework of the broadband PCS rules that prohibits excessively high-powered transmitters.²² This compatible use of complimentary services should be the FCC’s goal in crafting rules for this 700 MHz band.

C. The Record Supports an Allocation for Private Wireless Services.

As noted earlier, a large coalition of commenters, including Motorola, argued that a portion of the 746-806 MHz commercial allocation should be used to alleviate the gross

1990 the average yearly growth rate has been 39%.

¹⁹ See, *The FCC’s Advisory Committee For The 2000 World Radio-communication Conference Offers Additional Draft Proposals On WRC-2000 Issues*, DA 99-1364, Public Notice, released July 14, 1999.

²⁰ With the PCS and WCS allocations, the FCC has already allocated some 150 MHz of CMRS spectrum over the past 6 years.

²¹ Motorola notes that other bands are under consideration for 3G applications and urges the FCC to move forward on those proposals keeping in mind the global nature of 3G.

²² See 47 C.F.R. §24.232 (antenna height and power limits). See also, 47 C.F.R. §24.3 (permissible communications prohibiting broadcast services).

spectrum congestion in private wireless frequency bands. ITA's comments captured the fundamental position of all private wireless interests by stating that "spectrum allocations for the private wireless industry are in the public interest as they achieve a high level of spectrum use efficiency and contribute to the overall economic and social welfare of the American public."²³

As indicated in its comments, Motorola agrees with these views and believes that the 700 MHz band is well suited to help support the needs of the private wireless community. The record here and in other recent forums has well documented the urgent need for continued FCC support for private wireless spectrum allocations. Efforts such as the COPE petition,²⁴ the NTIA land mobile spectrum study,²⁵ an FCC Staff report,²⁶ and the LMCC Petition,²⁷ all clearly show the congestion in the existing Private Mobile Radio Service (PMRS) bands. In addition, some of these studies, primarily the NTIA study and the LMCC petition, clearly articulate the estimated need for spectrum for this service.²⁸ Despite these recommendations, the last significant spectrum allocation for

²³ Comments of ITA at 10.

²⁴ Coalition of Private Users of Emerging Multimedia Technologies (COPE), FCC Petition for Rule Making, Spectrum Allocations for Advanced Private Land Mobile Communications Services, filed 12/23/93. COPE represents many private users of land mobile radio, including public safety organizations such as the Association of Public Safety Communications Officials, International (APCO) and the Public Safety Communications Council (PSCC).

²⁵ Land Mobile Spectrum Planning Options, NTIA Report, October 19, 1995

²⁶ Private Land Mobile Radio Services: Background, Federal Communications Commission Wireless Telecommunications Bureau Staff Paper, December 18, 1996

²⁷ See note 11 *supra*.

²⁸ The LMCC Petition cites a need of 15 MHz by the year 2000, 44 MHz by the year 2004, and 125 MHz by the year 2010. The NTIA Requirements Study, conducted in 1995, found that 204 MHz of spectrum was required for land mobile services by the year

non-public safety, private mobile service occurred more than ten years ago. At the same time, portions of the spectrum previously used for private land mobile have been transitioned to Commercial Mobile Radio Service (CMRS) use through the auction process.

The 700 MHz spectrum is ideal to reverse the recent losses of the private mobile radio service. Existing nearby allocations at 800 MHz will facilitate product development and availability. More importantly, over the past 70 years, private wireless services have proven to be a compatible and complimentary spectrum neighbor with public safety services. Indeed, a PMRS 700 MHz allocation would benefit public safety by providing a larger market for similar types of equipment resulting in higher volumes, lower per-unit production costs, and therefore less expensive equipment for both PMRS and public safety users. Therefore, Motorola also supports the exclusive allocation of a portion of this spectrum to meet the needs of the private wireless services.

In its previous comments in this proceeding, Motorola addressed how allocating a portion of this 36 MHz of spectrum for PMRS would be consistent with the Balanced Budget Act of 1997(BBA-97) requirement that this spectrum be deployed for commercial use. This point was also addressed by UTC who noted that there is nothing in the statute that prevents the assignment of spectrum for private radio services.²⁹ However, it is clear that unless superceded by future legislation, the BBA-97 leaves the FCC with little option

2005. Of this amount, NTIA forecast that 50 MHz would be required for new advanced private land mobile services, including public safety and industrial uses. The Intelligent Transportation System was forecast as needing 85 MHz, which included short-range information exchange systems and vehicular collision-avoidance data links. Commercial users and other private and Federal land mobile systems accounted for the remaining 69 MHz.

but to distribute licenses, even private wireless licenses, through a competitive bidding process.

While auctions are far from the ideal licensing mechanism for private wireless users, the current law leaves the Commission with little flexibility. However, the band manager concept raised in the *Notice* and further discussed by ITA³⁰ may be a reasonable compromise solution for efficiently distributing 700 MHz spectrum capacity to private wireless users. This approach can only work, however, if a portion of the band is tailored specifically for PMRS use.

Motorola views the role of band managers as distinct from CMRS licensees and service providers. Indeed, Motorola strongly believes that this licensing tool must not be used simply to circumvent CMRS obligations or to provide competitive CMRS services. Rather, the role of the band manager fundamentally must be to distribute spectrum and to provide frequency coordination service to PMRS users for PMRS systems. Once again, the only way that the band manager will be able to purchase the necessary aggregate spectrum is if specific segments of this band are allocated specifically for PMRS use.

Under the current frequency coordination process, most of the private wireless licensing activity is already delegated to industry. As an extension of this process, we believe it is important that band managers possess the expertise to ensure that interference among PLMR users is minimized and that the spectrum is deployed in an efficient manner consistent with the operational needs of private users.

²⁹ Comments of UTC at 2.

³⁰ Comments of ITA at 9.

III. Interference Concerns Must be Considered When Allocating the 746-806 MHz Commercial Spectrum

Motorola and several public safety interests emphasized in opening comments that of primary importance in designing the service rules for this spectrum must be the protection of the already allocated 700 MHz public safety spectrum.³¹ Particularly relevant are the comments of APCO that direct the FCC to Motorola's recommendations regarding interference protection limits that were submitted and approved in the recent proceeding to develop service rules for public safety use of the 700 MHz band.³² APCO also points out that the type of interference which is of great concern in this band has already been seen in the 800 MHz band, that is, where low-site, low-power commercial systems are intermixed in a common area and operate on adjacent frequencies to public safety systems employing high antenna height, wide area coverage systems.³³

In the 800 MHz land mobile bands, public safety systems have received interference from adjacent spectrum commercial systems deployed in a low-power, cellular-like configuration, even though both parties were operating in accordance with the rules. These existing interference situations demonstrate the difficulty of accommodating differently configured systems using the same or adjacent channels. Fortunately, most of the incidents of interference which have been reported have been solved through the commercial carriers' willingness to work cooperatively with the affected public safety entities and the use of frequency coordination to minimize the

³¹ See Comments of APCO; Comments of International Association of Fire Chiefs, Inc. and International Municipal Signal Association; Comments of Region-20 821 MHz Public Safety Review Committee

³² Comments of APCO at 4.

³³ Id. at note 3.

problems. However, even these relatively few situations had the potential to disrupt important public safety communications and to require that both commercial carriers and public safety entities dedicate scarce staff time and resources to developing a solution. This emphasizes once again the importance of coordinating the spectrum correctly from the outset.

Further mitigating the harmful effects of these interference situations has been the fact that the interfering sources comply with, and sometimes even greatly surpass, the minimum performance specifications of the relevant emissions mask³⁴ and, therefore, are providing excellent adjacent channel protection. Indeed, these particular 800 MHz technologies are providing superior out-of-band emission characteristics to the minimum proposed requirement of $43+10\log_{10}(P[\text{Watts}])$ or 80 dB as proposed in the instant *Notice*.³⁵ Yet, as APCO states, interference events have occurred.³⁶ Clearly, if the Commission takes no action other than adopting the emission restriction it has proposed, there will be many more severe incidents of commercial systems causing interference to public safety systems.

While interference management in this band is of critical importance, Motorola does not believe that it is an insurmountable obstacle to the successful deployment of systems. The interference scenarios, however, must be clearly understood, and the Commission must be proactive in its efforts to avoid these potential problems.

³⁴ 47 C.F.R. §90.210

³⁵ *Notice* at ¶ 69. *See also*, attached Figure 1: “Comparison of FCC Proposed Emission Limits With Part 90 Emission Mask and Technology” for a graphical depiction of the proposed attenuation levels versus existing requirements and technology.

³⁶ *See also*, “Interference: Conflicts of Public Interest”, Joe Kuran, Mobile Radio

There are several steps that the Commission can take to avoid the most serious interference problems. First, as has been mentioned several times, the FCC should avoid mixing services that are of fundamentally different configurations. The FCC should not permit traditional high-site, high-power TV broadcast operations in this band, where antenna heights may be hundreds of meters and ERPs may be in the Megawatt range. Antenna height and base station EIRP restrictions for the band should be consistent with mobile system operation.

Second, the Commission should recognize that mixing paired and unpaired spectrum would be extremely problematic. The public safety spectrum has already been allocated on a paired basis, anticipating the use of frequency division duplex (“FDD”) technologies. Some commenters have suggested that the commercial-use spectrum should be left unpaired so that time division duplex (“TDD”) technologies can be used as well.³⁷ While Motorola recognizes that there are many excellent TDD technologies on the market today and being planned for the future, we do not believe that it would be prudent to attempt to allow both FDD and TDD technologies to share the same spectrum band. Motorola therefore recommends that the FCC channelize the commercial-use spectrum for the FDD mode using the same transmit and receive band orientation as assigned to the public safety allocation (base and mobile stations transmissions in the 746-764 MHz band; mobile transmissions in the 776-794 MHz band).

Even if the FCC implements the fundamental principles discussed above, other interference situations need to be addressed. The scenarios will be dramatically more

Technology, March 1999.

³⁷ See Comments of ArrayComm, at 5.

problematic without an interference management program that far exceeds the FCC proposal that transmitters attenuate their out of band emissions by at least $43 + 10 \log_{10}(P)$ watts or 80 decibels, whichever is less, for any emission outside the licensee's authorized spectrum.³⁸

The FCC's proposed emission schedule would result in out of band power levels of -13 dBm for most transmitter powers that typically would be used in a land mobile system.³⁹ As part of its Comments to the Second Notice of Proposed Rule Making in the public safety proceeding, Motorola offered an analysis of various commercial-use to public safety interference situations. This analysis led to our proposed out of band emission limits that rely on the Adjacent Channel Coupled Power (ACCP) concept to adequately protect public safety systems.⁴⁰ Motorola's recommendations were, for the most part, adopted by the FCC for operations within the public safety allocation and codified at Section 90.543 of the rules.⁴¹ We recommend that the Commission extend that policy here and adopt the same inter-system interference protection requirements necessary to protect the public safety allocation.

In the following section, we describe the various interfaces between this new allocation for commercial-use and existing allocations noting the potential interference scenarios, their possible ramifications, and the impact of the FCC's proposed out-of-band

³⁸ Notice at ¶ 69.

³⁹ The 80 dB limit does not take effect until the transmitter power reaches 5000 Watts. Land mobile base stations do not typically operate at powers exceeding a few hundred Watts. Most, in fact, operate near 100 W.

⁴⁰ See Comments of Motorola to the Second NPRM in WT Docket 96-86, Appendix, filed December 22, 1997.

⁴¹ See, First Report and Order and Third Notice of Proposed Rule Making in WT Docket

emission requirements against Motorola's proposed ACCP requirements. We will then discuss how an allocation of PMRS spectrum can be used to mitigate potential interference to the public safety allocation.

A. 764 MHz Interface: Commercial-Use Base Transmitters To Public Safety Mobile Receivers

At 764 MHz the commercial-use base transmit band is adjacent to the public safety mobile receive band. This has the potential to create coverage holes for public safety users in locations near the commercial-use base transmit sites. If public safety mobile units were to get close⁴² to a site employing frequencies closely spaced from the desired band, the strong undesired base station transmitter signals would produce intermodulation products that would fall in the receive band of the public safety mobile receiver.⁴³ This would result in destructive interference to a normally strong desired public safety signal. In addition, side band noise from multiple sources can cause interference. This is what has been seen in the 800 MHz SMR band where ESMR systems are intermingled in the same band with public safety systems. Units close to the interfering site cannot receive relatively strong desired signals. This identical configuration occurs between the 866-869 MHz public safety mobile receive band and the 869-894 MHz cellular base transmit band. And, indeed, this same interference scenario occurs at the band interface at 869 MHz where cellular sites can create dead zones around them for public safety systems. Since base transmitters do not employ

96-86. Released September 29, 1998.

⁴² Typically within a quarter to a half-mile.

⁴³ The most difficult type of this class of problem is receiver intermodulation (IM) where the IM products are generated in the victim receiver. Increasing receiver IM performance is not easy as it increases the cost of the receiver and consumes additional battery power.

power control, the presence of continuous high power carriers makes this a high probability occurrence.

As mentioned above, this scenario has already been responsible for numerous occurrences of interference in the 800 MHz SMR band as well as in the 866 - 869 MHz public safety band. Typical site isolation to mobile units (path loss between a mobile unit and a base site) is approximately 75 dB.⁴⁴ This would result in interference levels around the site of approximately $-13 \text{ dBm} - 75 \text{ dB} = -88 \text{ dBm}$ per source from the base transmitters. This is already quite high, and when reinforced by multiple sources and the potential for intermodulation products the situation will produce coverage dead spots around sites.

B. 776 MHz Interface

Scenario I: Public Safety Base Transmitters To Commercial-Use Base Receivers

At 776 MHz, the public safety base station transmit band is directly adjacent to the commercial-use base station receive band. Public Safety base stations transmitting on frequencies below, but very close to, the 776 MHz interface will interfere with commercial-use base station receivers on frequencies above, but very close to, the interface.

There are two interference mechanisms that are possible: receiver desensitization and transmitter side band noise. The victim (commercial-use, in this case) receivers must

This makes the radios larger, heavier, and more costly.

⁴⁴ See Appendix of Motorola Comments to the Second Notice of Proposed Rule Making in WT Docket 96-68. "A minimum mobile station antenna port to fixed station antenna port path loss (independent of the antenna gains) for moderate base heights of 100-200 feet is 75dB." In free space, the path loss between two dipoles spaced by 200 feet at 750

have sufficient selectivity to protect themselves from desensitization due to the closely spaced but undesired signals. The source (public safety, in this case) transmitters need to have sufficient suppression of out of band (OOB) emissions.

This is a potentially serious problem. A similar problem currently exists between the 800 MHz cellular B carriers and the 900 MHz SMR band. The 869-894 MHz band is the cellular base station transmit band, while 896-901 MHz is the 900 MHz SMR base station receive band. Because they are in separate frequency blocks, no cross band frequency coordination is required. Thus, sites are randomly mixed with situations where a cellular B carrier has transmitters whose antenna bore site is aimed directly at a 900 MHz SMR base station's receive antenna. Even with a 2 MHz guard band,⁴⁵ serious desensitization due to legal but relatively high OOB emissions have been observed resulting from the very low free space loss condition that can exist for this scenario.

As discussed above, this scenario has also already been responsible for interference events between the cellular B carriers and the 900 MHz SMR operators. The Commission's out-of-band emission proposal is no more stringent than that used there, so there is no reason to believe that similar interference events will not occur.

Scenario II: Commercial-Use Mobile Transmitters To Public Safety Mobile Receivers

Also at 776 MHz, the commercial-use mobile station transmit band is directly adjacent to the public safety mobile station receive band. This is the opposite of the situation described above, and results in commercial-use mobile units interfering with

MHz would be $PL(dB) = 36.6 + 20\log_{10}(f_{MHz}) + 20\log_{10}(R_{miles}) - 2 \times 2.15 = 61.4$ dB.

⁴⁵ From 894-896 MHz there is an allocation for the commercial aviation air-to-ground service. This is located between the cellular radio base station transmit band from 869-

public safety mobile units. When mobile units are in close proximity, the closely spaced signals and side band noise can disrupt communications links that would work if the interference sources were not present.

This is a potentially dangerous scenario. During any large-scale disaster (airplane crash, bombing, earthquake, etc.) it is expected that large numbers of people using commercial wireless equipment will be in close proximity to public safety personnel. In such a situation, this interference scenario could be extremely serious.

The FCC proposal allows a –13 dBm signal to be emitted on any frequency in the commercial band and also into the public safety band. This is a very strong interfering signal when units are in close proximity. The loss between units is highly variable, depending on the likelihood of units operating in the same area. Since public safety users require access to most locations, it would appear that major activities such as fire fighting would create the greatest probability of this occurring. Assuming a free space loss of approximately 18 dB (between dipoles) in the first wavelength and 6 dB increase for each doubling, the loss at close distances would be:

$$Loss(dB) = 18 + 20 \log_{10} \left(\frac{D_{ft}}{1.25} \right)$$

For example, at 100 feet of separation the loss would be 56 dB. When a –13 dBm source is isolated by 56 dB the resultant signal would be –13 dBm – 56 dB = –69 dBm, an extremely harmful level.

894 MHz, and the SMR base station receive band at 896-901 MHz.

C. 794 MHz Interface: Commercial-Use Mobile Transmitters To Public Safety Base Receivers

At 794 MHz, the commercial-use mobile transmit band is directly adjacent to the public safety base station receive band. This is the classic “near-far” situation where a base station is prevented from receiving a weak, desired signal by the presence of a strong undesired signal at a nearby frequency. When a public safety base receiver is receiving a moderate-to-weak desired signal from a far away public safety mobile unit, a strong undesired signal on a nearby frequency from a nearby commercial-use transmitter with insufficient out-of-band emission characteristics can desensitize the base receiver and interfere with successful reception.

Since a transmitter would have to have an ERP of 5000 watts before the 80 dB reduction would be in effect, -13 dBm is all that can be considered for system planning purposes. With 75 dB of mobile to site isolation, this can produce -88 dBm interfering signal levels. Since the desired signal has to be greater than that, this would dramatically reduce the coverage when commercial-use radios are close in both the geographic sense and in the sense of transmitting a signal close in frequency to the desired signal.

Normally frequency coordination is used to resolve this type of scenario. If the commercial-use portion of the band is area licensed whereas the public safety portion is site licensed, no information will be present to facilitate any form of frequency coordination. Power control of mobile unit transmitters cannot be counted on to mitigate this form of interference unless the systems are co-located. Unless the interfering signal is dramatically reduced to less than -13 dBm, interference will occur.

D. 746 MHz Interface With TV Channel 59 Operations

The interface at 746 MHz is not a public safety interference situation, but it is a situation that will dramatically impact the usability of this band depending on how it is handled. Traditional high power TV broadcast operates below 746 MHz. Channel 59 operates in the spectrum immediately below 746 MHz. There are seven analog channel 59 TV stations in the US, and 22 DTV allocations to channel 59⁴⁶. There are also about seven Canadian TV stations on channel 59 in the US/Canada border region, and likely a few in the US/Mexico border region as well. Since there is no timeframe established yet for moving broadcast TV out of the spectrum below 746 MHz, this interference situation will persist beyond the year 2006 transition date to DTV. Existing TV/land mobile sharing criteria in the 470-512 MHz band require that land mobile systems with mobile units associated with a base station operate no closer than 90 miles to an adjacent channel TV station.⁴⁷ Such a situation would imply large areas that could not be covered by the commercial-use systems.⁴⁸ For some service offerings this could have devastating effects on the viability of a business plan for commercial-use operations in this spectrum, especially in the highly populated eastern United States.

E. Allocating Spectrum To The Private Mobile Radio Service Can Help Manage Critical Interference Regions

A judicious allocation of spectrum at the most critical points in this band for the private mobile radio service would be appropriate for addressing all of the interference

⁴⁶ See Second Memorandum Opinion And Order On Consideration Of The Fifth And Sixth Report And Order, MM Docket No. 87-268, Appendix B.

⁴⁷ 47 CFR §90.309 Table E

⁴⁸ See attached “Figure 2: Channel 59 Allocations” for a graphical depiction of the 90 mile exclusion area of existing channel 59 stations.

issues raised above. Because of the history of frequency and transmitter site location coordination between the PMRS and public safety communities, it is reasonable to expect that this cooperation will continue. Key interfaces between the PMRS and the public safety spectrum will be managed on that basis, thus protecting the vital public safety operations. In addition, an allocation of PMRS spectrum at the 746 MHz interface might serve to alleviate the problems that will be faced by the commercial-use services when operating in areas with channel 59 TV assignments.

F. PMRS Is Better Able To Interface With Other Commercial-Use Systems Than Is Public Safety

It is clear that such a proposal simply shifts the burden of interfacing with the other cellular-like systems (3G, Internet access, etc.) to the PMRS community. It is reasonable to ask why this is a better solution than simply allowing public safety to deal with the interference. The reason is that the requirements of the two services are different enough to make this possible. For example, all public safety communications can be considered critical communications. While there are undeniably elements of the private mobile radio service who also have highly critical communications, there are others whose communications are not as critical. The private sector frequency coordination process could easily be used, for example, to put other critical communications services near to the public safety allocation and away from interference, while less critical communications would be located closer to the sources of interference.

In addition, as we have discussed in other proceedings,⁴⁹ one of the many reasons why PMRS users do not simply transition all of their communications onto CMRS

⁴⁹ See Reply Comments of Motorola to the LMCC Petition, Section IV.

systems is because of the different coverage requirements. Large commercial carriers typically deploy their systems so that there is coverage in the regions with the densest populations, while private mobile radio users need coverage wherever their operations take them. This means that PMRS systems are often deployed as in-building systems (where shielding from the building will protect them from the wide area systems) or in lesser-populated areas, where the probability of interference from wide area systems is reduced. In addition, private radio systems are typically deployed on a site-by-site basis, while the other likely commercial-use operations that will use this band will strive for wide areas of uninterrupted coverage. Therefore, it is easier for PMRS systems users to avoid areas of interference (including those caused by adjacent channel TV) than it would be for an operator attempting to deploy a system with wide area coverage.

Assigning some PMRS spectrum near the critical commercial-use/public safety interfaces would similarly protect the public safety allocations. Such protection could also be secured by designating a guard band at these interfaces, or instituting a requirement that the commercial-use licensee allocate some of the spectrum to act as a guard-band to protect the public safety operations. Neither of these latter ideas is optimal, however, because they both result in this “guard spectrum” being completely unused, anywhere, at any time. The advantage to allocating some of this spectrum for use by the private mobile radio service is that the operations of this service, as discussed above, make it possible for this spectrum to achieve its maximum productivity while still acting to protect the public safety allocations.

To summarize, the following reasons explain why an allocation of some spectrum near the critical interface regions to the private mobile radio service is a prudent way of

minimizing the interference situations that likely will be present in the 746-806 MHz band:

1. PMRS users are in desperate need of new spectrum allocations as has been well documented and supported by the record in this and other proceedings.
2. The similarity and historical cooperation between the public safety service and PMRS makes PMRS the ideal neighbor to guarantee the protection of the public safety allocation.
3. An adjacent allocation for the two services will create a larger market for equipment, which will result in lower equipment costs for users in both markets.
4. PMRS users are better able to operate in spectrum adjacent to larger commercial-use carriers than are public safety users. In addition, PMRS users are better able to operate in spectrum adjacent to current TV broadcasting than are larger commercial-use carriers.
5. Due to their operational characteristics (remote areas, in-building systems, etc.) the PMRS users are best able to put spectrum which, one way or another will end up being used as a guard band, to productive uses wherever possible.

V. Protection of incumbent TV broadcast operations and Global Navigation Satellite System operations are still being addressed as part of the Public Safety proceeding

As stated in our Comments, the rules designed to protect incumbent TV broadcast operations should rationally be the same as those which will be used in the public safety portion of the 746-806 MHz spectrum. Motorola has an outstanding Petition for Reconsideration that addresses this topic.⁵⁰ We recommend that the FCC seek the counsel of its Office of Engineering and Technology to study our proposals on this issue, and resolve that Petition before deciding on similar rules for the commercial-use portion of the band.

Similarly, the issue of protection to the Global Navigation Satellite Systems (“GNSS”, such as GPS and GLONASS) is part of the record in the Third Notice of

⁵⁰ See Motorola’s Petition for Reconsideration and Clarification in WT Docket 96-86.

Proposed Rule Making in the public safety proceeding.⁵¹ In that proceeding we recommended that the Commission act to establish quickly a committee of experts from all of the concerned industries to examine the needs of these GNSS operations and recommend interference protection parameters to the Commission. We continue to support this view.

⁵¹ *See* Comments of Motorola to the Third Notice of Proposed Rule Making in WT Docket 96-86.

IV. Conclusion.

The reallocation and use of the 746-806 MHz band offers great potential to benefit a wide segment of the American people. Notwithstanding the urgency of the proceeding, the FCC must ensure that these service rule decisions maximize the beneficial uses of this spectrum. To that end, the FCC must provide that permitted technologies and services are compatible with adjacent services, particularly public safety users. Performing the necessary interference management analysis at the beginning of the assignment process will facilitate investments in research and product development and therefore expedite service to the American people and businesses.

Respectfully Submitted

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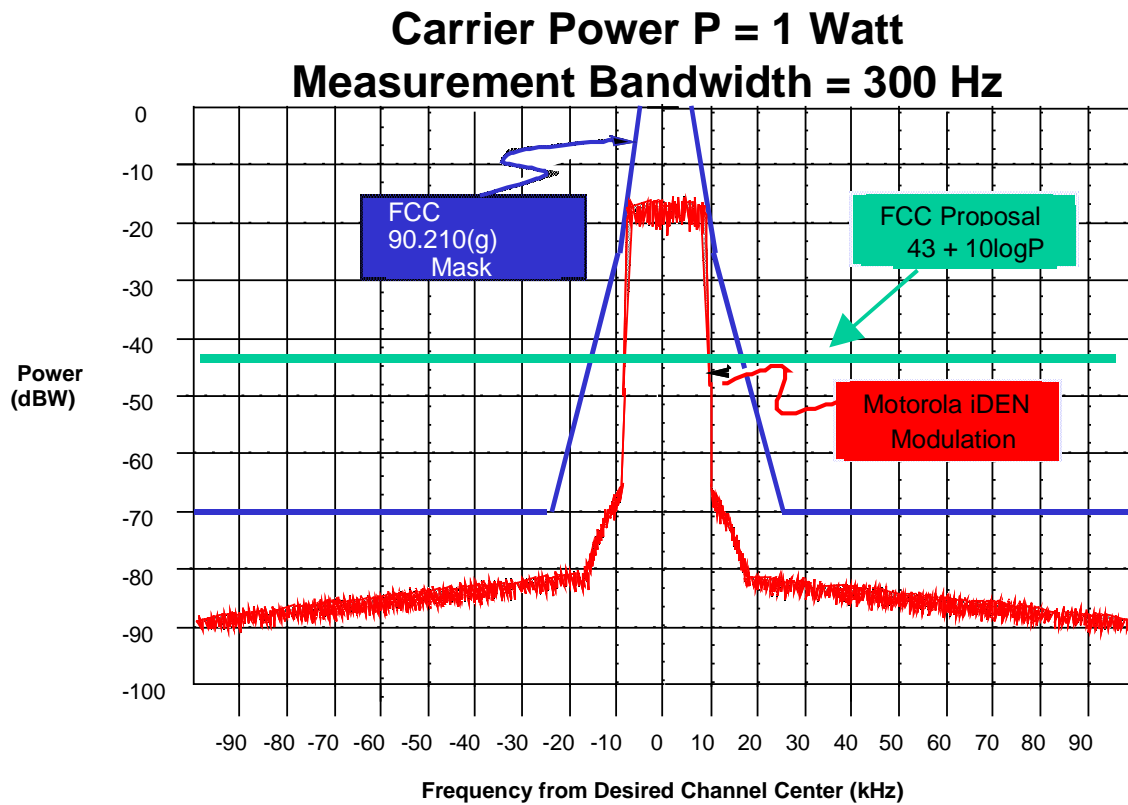


Figure 1: Comparison of FCC proposed emission limits with Part 90 mask and technology

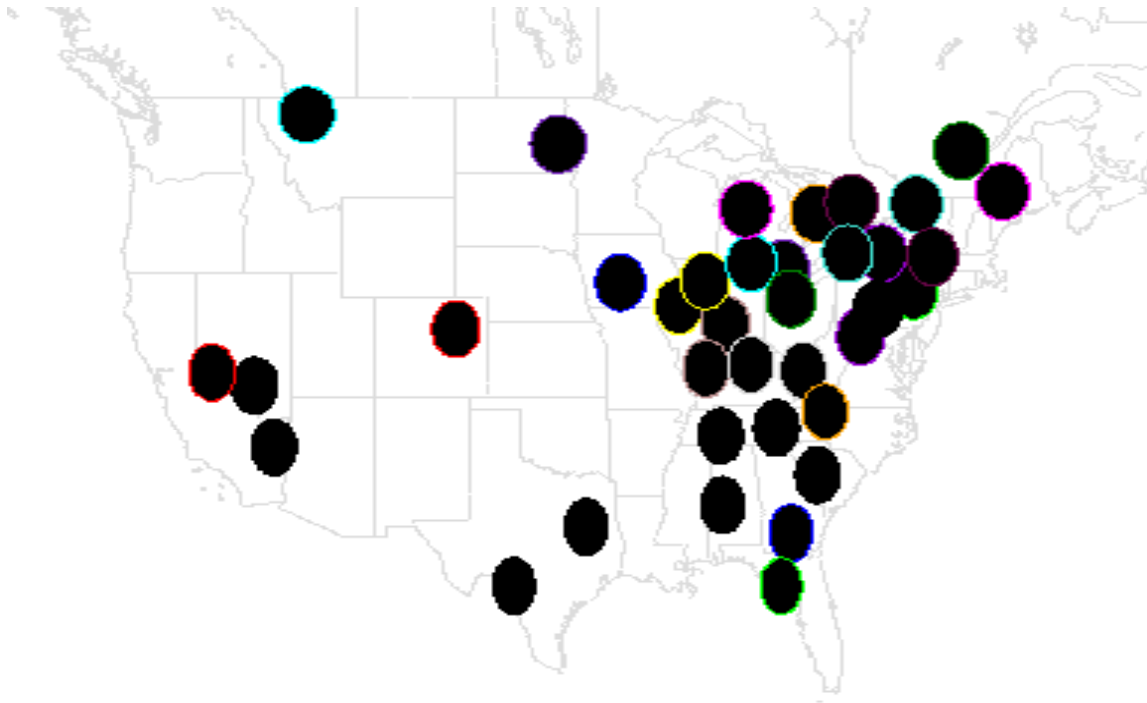


Figure 2: Channel 59 Allocations with 90 mile exclusion circles